San Diego Gas & Electric Company

California Public Utilities Commission

R.01-10-024

Workshop

Value at Risk, Cash Flow at Risk
And Other Measures of Portfolio Risk

April 23, 2003, 10:00 a.m.

State Civic Center Complex
455 Golden Gate Ave, San Francisco
Meeting Room 9

Risk Management Process

1) Quantifying Risk Position

2) Quantifying Risk Exposures

3) Calculating VaR

4) Using VaR to Manage Risk

5) Scenario: Effect of Hedge to VaR

6) Cash Flow at Risk

Quantifying Risk Position

1) **Establish SDG&E load forecast or "initial short" position**

2) **Total all existing must-take resources which include QF contracts, 6x16 and 7x24 URG & CDWR contracts, SONGS, etc.**

3) **If initial short position exceeds must-take resources, SDG&E either dispatches CDWR units or buys power from the market; expected CDWR dispatchable volumes are determined using spread option models**

4) **If model dispatches DWR units, result is short gas position; if model purchases market power, result is short power position**

Quantifying Risk Exposures

Sample Positions By Month (MWh for Power, MMBtu for Gas) - as of 4/21/03													
Month	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	2003 Total
Load (On-Peak)	75,000	75,000	75,000	60,000	60,000	60,000	100,000	100,000	100,000	80,000	80,000	80,000	945,000
Load (Off-Peak)	40,000	40,000	40,000	30,000	30,000	30,000	60,000	60,000	60,000	35,000	35,000	35,000	495,000
Resources (On-Peak)*	50,000	50,000	50,000	40,000	40,000	40,000	100,000	100,000	100,000	75,000	75,000	75,000	795,000
Resources (Off-Peak)*	25,000	25,000	25,000	18,000	18,000	18,000	50,000	50,000	50,000	23,000	23,000	23,000	348,000
Resulting Energy Position (On-Peak)	-25,000	-25,000	-25,000	-20,000	-20,000	-20,000	0	0	0	-5,000	-5,000	-5,000	-150,000
Resulting Energy Position (Off-Peak)	-15,000	-15,000	-15,000	-12,000	-12,000	-12,000	-10,000	-10,000	-10,000	-12,000	-12,000	-12,000	-147,000
Resulting Gas Position	-200,000	-200,000	-200,000	-160,000	-160,000	-160,000	-500,000	-500,000	-500,000	-300,000	-300,000	-300,000	-3,480,000
SP 15 Price (On-Peak)	$ 50.00	$ 55.75	$ 66.00	$ 75.25	$ 81.75	$ 70.50	$ 56.25	$ 57.25	$ 58.75	$ 57.75	$ 56.00	$ 55.00	
SP 15 Price (Off-Peak)	$ 33.00	$ 32.25	$ 36.75	$ 41.25	$ 49.25	$ 41.25	$ 45.00	$ 38.00	$ 39.00	$ 38.25	$ 36.25	$ 35.25	
SoCal Border Gas Price	$ 5.30	$ 5.32	$ 5.40	$ 5.60	$ 5.70	$ 5.65	$ 5.64	$ 5.69	$ 5.78	$ 5.84	$ 5.70	$ 5.42	
Realized Energy Cost (On-Peak)	$ (1,250,000)	$ (1,393,750)	$ (1,650,000)	$ (1,505,000)									$ (5,798,750)
Realized Energy Cost (Off-Peak)	$ (495,000)	$ (483,750)	$ (551,250)	$ (495,000)									$ (2,025,000)
Realized Gas Cost	$ (1,060,700)	$ (1,064,160)	$ (1,080,600)	$ (895,360)									$ (4,100,820)
MTM Energy Cost (On-Peak)					$ 1,635,000	$ 1,410,000	$ 0	$ 0	$ 0	$ 288,750	$ 280,000	$ 275,000	$ 3,888,750
MTM Energy Cost (Off-Peak)					$ 591,000	$ 495,000	$ 450,000	$ 380,000	$ 390,000	$ 459,000	$ 435,000	$ 423,000	$ 3,623,000
MTM Gas Cost					$ 911,360	$ 904,160	$ 2,818,000	$ 2,843,000	$ 2,890,500	$ 1,752,300	$ 1,708,800	$ 1,626,300	$ 15,454,420
Total MTM Cost (Exposed to Market)					$ 3,137,360	$ 2,809,160	$ 3,268,000	$ 3,223,000	$ 3,280,500	$ 2,500,050	$ 2,423,800	$ 2,324,300	$ 22,966,170

*Resource quantities based on economic comparison of dispatchable capacity cost to forward energy prices

Calculating VaR - Simplified Risk Exposure Measurement

1) Mark-to-market costs are based on current forward prices for gas and power times the open short position for gas and power

2) Primary risk drivers are price volatility and correlation:

- **a) Higher price volatility results in higher-risk portfolio**
- **b) Higher correlations result in higher-risk portfolio due to lack of diversification benefits**

3) Example: From previous slide, make simplifying assumption that all prices are perfectly correlated with an expected 10% volatility (at a 95% confidence level) over a pre-defined exposure period of 3 days (sufficient time to cover exposure)

4) The VaR is then 10% of $23 million, or $2.3 million

5) Inputs include market prices, forward price volatility and background calculations to produce exposure volumes

Calculating VaR - VTE (VaR-To-Expiration) Measurement

1) The VTE model assumes holding period through delivery instead of a pre-defined exposure period; probable price movements are mapped forward over holding period to determine potential loss

Calculating VTE over holding period results in significantly larger risk measurement – depending on length of holding period, risk can be several times higher than the 3-day exposure calculation

2) The full risk model also includes the following refinements:

a) Load uncertainty
b) Price premium above standard block energy prices to serve shaped load profile
b) Correlation of price movements between gas/power and delivery periods

Using VaR To Manage Risk

1) **The Customer Risk Tolerance is a dollar total calculated by multiplying 1 cent/kWh to the total retail sales quantity**

2) **SDG&E tracks the MTM cost of open position plus actual costs to date; if prices rise such that the cost increase plus the portfolio VTE exceed the CRT, then action is taken to mitigate the possibility that year end costs will be greater than forecast + CRT:**

Rise in Actual Costs + Rise in MTM Costs + VTE < CRT

3) **Possible actions :**
   - a) **Buy physical power forward at fixed price**
   - b) **Buy financial swaps or options on power to protect against volatility**
   - c) **Similar action may be taken in the gas market to mitigate gas exposure**

- **Example of hedge to manage portfolio risk: Buy 200,000 MMBtu/month of gas for Q3 and Q4 at fixed price to reduce short gas position; this transaction reduces VTE which allows SDG&E to stay within CRT (as shown on following table)**

Scenario: Effect of Hedge to VaR (200,000 MMBtu/month Q3/Q4)

Sample Positions By Month (MWh for Power, MMBtu for Gas) - **AFTER** Hypothetical Gas Hedge of 600,000 MMBtu/Month

Month	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	2003 Total
Load (On-Peak)	75,000	75,000	75,000	60,000	60,000	60,000	100,000	100,000	100,000	80,000	80,000	80,000	945,000
Load (Off-Peak)	40,000	40,000	40,000	30,000	30,000	30,000	60,000	60,000	60,000	35,000	35,000	35,000	495,000
Resources (On-Peak)*	50,000	50,000	50,000	40,000	40,000	40,000	100,000	100,000	100,000	75,000	75,000	75,000	795,000
Resources (Off-Peak)*	160,000	160,000	160,000	130,000	130,000	130,000	240,000	240,000	240,000	65,000	65,000	65,000	1,785,000
Resulting Energy Position (On-Peak)	-25,000	-25,000	-25,000	-20,000	-20,000	-20,000	0	0	0	-5,000	-5,000	-5,000	-150,000
Resulting Energy Position (Off-Peak)	-15,000	-15,000	-15,000	-12,000	-12,000	-12,000	-10,000	-10,000	-10,000	-12,000	-12,000	-12,000	-147,000
Resulting Gas Position	-200,000	-200,000	-200,000	-160,000	-160,000	-160,000	**-300,000**	**-300,000**	**-300,000**	**-100,000**	**-100,000**	**-100,000**	**-2,280,000**
SP 15 Price (On-Peak)	$ 50.00	$ 55.75	$ 66.00	$ 75.25	$ 81.75	$ 70.50	$ 56.25	$ 57.25	$ 58.75	$ 57.75	$ 56.00	$ 55.00	
SP 15 Price (Off-Peak)	$ 33.00	$ 32.25	$ 36.75	$ 41.25	$ 49.25	$ 41.25	$ 45.00	$ 38.00	$ 39.00	$ 38.25	$ 36.25	$ 35.25	
SoCal Border Gas Price	$ 5.30	$ 5.32	$ 5.40	$ 5.60	$ 5.70	$ 5.65	$ 5.64	$ 5.69	$ 5.78	$ 5.84	$ 5.70	$ 5.42	
Realized Energy Cost (On-Peak)	$ (1,250,000)	$ (1,393,750)	$ (1,650,000)	$ (1,505,000)									$ (5,798,750)
Realized Energy Cost (Off-Peak)	$ (495,000)	$ (483,750)	$ (551,250)	$ (495,000)									$ (2,025,000)
Realized Gas Cost	$ (1,060,700)	$ (1,064,160)	$ (1,080,600)	$ (895,360)									$ (4,100,820)
MTM Energy Cost (On-Peak)					$ 1,635,000	$ 1,410,000	$ 0	$ 0	$ 0	$ 288,750	$ 280,000	$ 275,000	$ 3,888,750
MTM Energy Cost (Off-Peak)					$ 591,000	$ 495,000	$ 450,000	$ 380,000	$ 390,000	$ 459,000	$ 435,000	$ 423,000	$ 3,623,000
MTM Gas Cost					$ 911,360	$ 904,160	######	######	######	**$ 584,100**	**$ 569,600**	**$ 542,100**	**$ 8,642,220**
Total MTM Cost (Exposed to Market)					$ 3,137,360	$ 2,809,160	$ 2,140,800	$ 2,085,800	$ 2,124,300	$ 1,331,850	$ 1,284,600	$ 1,240,100	$ 16,153,970

*Resource quantities based on economic comparison of dispatchable capacity cost to forward energy prices

Scenario: Net Effect of Hedge to VaR

Month	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	Nov-03	Dec-03	2003 Total
UNHEDGED													
Total MTM Cost (Exposed to Market)	$ -	$ -	$ -	$ -	$ 3,137,360	$ 2,809,160	$ 3,268,000	$ 3,223,000	$ 3,280,500	$ 2,500,050	$ 2,423,800	$ 2,324,300	$ 22,966,170
HEDGED													
Total MTM Cost (Exposed to Market)	$ -	$ -	$ -	$ -	$ 3,137,360	$ 2,809,160	$ 2,140,800	$ 2,085,800	$ 2,124,300	$ 1,331,850	$ 1,284,600	$ 1,240,100	$ 16,153,970
EFFECT OF HEDGE													
Reduction to MTM Exposure	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,127,200	$ 1,137,200	$ 1,156,200	$ 1,168,200	$ 1,139,200	$ 1,084,200	$ 6,812,200
Sample VTE factors					15%	20%	35%	40%	40%	35%	35%	40%	
Reduction to VTE	$ -	$ -	$ -	$ -	$ -	$ -	$ 394,520	$ 454,880	$ 462,480	$ 408,870	$ 398,720	$ 433,680	$ 2,553,150

Cash Flow at Risk (CFAR)

1) **Similar to Customer Risk Tolerance, SDG&E also models ERRA headroom to determine the likelihood of over- or under-collections:**

Retail Revenue – CDWR Remittance – ERRA Costs = Headroom

2) **However, results are highly uncertain since ERRA-designated collections are residual to CDWR payments which are subject to rate changes imposed by CDWR**